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ABSTRACT

Three modules designed to teach creative problem solving are included. Although prepared for mathematics teachers, the situations used are non-mathematical. The modules are entitled "Application of Deferred Judgment," "Recognizing the Real Problem," and "Developing the Solution." Instructor's guides for all modules are included together with the student workbook for the third module. For each module, goals are stated, operational objectives defined, and teaching procedures outlined in terms of desired learning outcomes, instructor behavior, and student behavior. Students are given practice in brainstorming, problem redefinition, generating and evaluating solutions, and overcoming mental sets. (EB)

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CREATIVE PROBLEM SOLVING

Preliminary Edition

Investigator: E. Glenadine Gibb
Mathematics Education

The Research & Development Center For Teacher Education

THE UNIVERSITY OF TEXAS
AUSTIN

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TABLE OF CONTENTS

		Page
I.	WHITE PAGES	
	Creative Problem Solving -- Preface	1
II.	GOLD PAGES -- Application of Deferred Judgment	
	Introduction	3
	Goals	3
	Operational Objectives	3
	Rationale	4
	References	4
	Materials	5
	Procedure	6
	Comments	7
	Exercise -- Deferred Judgment	8
III.	BLUE PAGES -- Recognizing the Real Problem	
	Introduction	15
	Goals	15
	Operational Objectives	15
	Rationale	16
	References	16
	Materials	17
	Procedure	17
	Comments	18
	Exercise -- Recognizing the Real Problem	19

		Page
IV.	PINK PAGES -- Developing the Solution - Instructor's Guide	
	Introduction	28
	Goals	29
	Operational Objectives	29
	Rationale	29
	References	30
	Material	30
	Procedure	30
	Comments	31
	Statement of the Problem -- "What should the bus driver do?	32
	Solution Development Worksheets Parts 1 - 5 [Completed Worksheets]	33 - 37
	Illustration of Creative Problem-Solving Thought Process on a Very Minor Problem	38
V.	GREEN PAGES -- Developing the Solution - Student Workbook	
	Operational Objectives	41
	Solution Development Worksheets Parts 1 - 5 [Blank Worksheets]	42 - 46
	Statement of the Problem -- "What should the bus driver do?"	47
	Solution Development Worksheets Parts 1 - 5 [Blank Worksheets]	48 - 52
	Illustration of Creative Problem-Solving Thought Process on a Very Minor Problem	53

CREATIVE PROBLEM SOLVING

Preface

Change is ever-occurring in the world at large and is especially common in education and in mathematics. Since change, almost by definition, means problems for which there are no prescribed solutions, it can be readily seen that the future belongs to those who are most able to identify the problems that exist and are capable of developing workable solutions for those problems. This series of modules has been developed to engage its user in creative problem solving activities, which require them to confront the situation, to identify the problem, develop the solution, and to assess the adequacy of their solutions. Each of the modules in this set has its own subset of goals which seek to guide each user in developing his creative problem solving capability.

The choice of non-mathematical situations as learning devices is predicated on a number of considerations. The non-mathematical situation reduces the likelihood of confrontation with mathematics "experts" and makes all participants "experimentalists" in facing the problem situation. Thus, the user can work individually and in groups to develop criteria for considering a solution acceptable. The objective is that the attitudes, concepts, and skills learned through these experiences be transferred to mathematics-teaching situations.

A goal of teaching mathematics is to develop in each child the attitudes, concepts, and skills that will be needed in the adult world of tomorrow. We, as adults and teachers in the world of today, no longer believe that we have identified and solved all of the problems our children and students will be asked to solve. We only know that they will be asked to solve many complex problems and that the quality of their

lives and the lives of suceeding generations depends in large measure on the adequacy of their solutions. We also recognize that the absence of a final answer extends into mathematics and mathematics teaching. Thus, the experiences provided in this set of modules are designed to guide the professional development of teachers of mathematics that they may become effective teachers of mathematics for all children, capable of adapting to changes in mathematics and mathematics curriculum; in general, to any and all changes whatever their source.

APPLICATION OF DEFERRED JUDGMENT

APPLICATION OF DEFERRED JUDGMENT

Introduction

It is essential that today's educators be aware of the negative effects of pre-judgment on the idea producing process and of the quantitative and qualitative efficiency of the application of the principle of deferred judgment to their own idea-producing capabilities. Such awareness will enable teachers to:

1) improve the number and quality of the ideas that they develop in response to their own day-to-day problems, and

2) to develop insights and to convert these insights into productive adjustments to life and work.

I. Goals

This module is designed to enable the users to demonstrate to themselves that:

1) the practice of pre-judgment reduces the number and variety of ideas that are produced in response to a problem.

2) the practice of deferring judgment until later in the problem solving process increases both the quantity and quality of the ideas produced.

3) the production of ideas through the application of deferred judgment can be taught.

II. Operational Objectives

At the end of this session, the participants should agree that:

1) pre-judgment of ideas reduces idea producing capabilities

2) the application of deferred judgment improves the quantity and quality of ideas produced both by individuals and by groups

3) improved production of ideas can be taught by means of instruction and practice.

III. Rationale

Teachers at all levels, despite the extent of their experience, are often reluctant to express their own ideas, especially if those ideas have not been confirmed or tested by previous experiences. What the teacher fails to realize is that previous experiences do not always relate to the problems at hand and that a new, unconfirmed idea may be quite valid. By prejudging, the teacher limits his own solution-finding abilities and tends to be hypercritical of the ideas of his contemporaries and of his students. Such attitudes in the behavior patterns of teachers tend to restrict their own mental capabilities and to encourage the same negative attitude to be developed by their students.

This module proposes, first, to demonstrate the use of pre-judgment so that the process may be analyzed for its limitations. Second, the module stresses that deferring judgment until all the responses to a problem have been gathered will result in a greater number of ideas and that these ideas will be considered by the members of the class as superior to those produced after pre-judgment.

IV. References

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Banghart, F. W. and Spraker, H. S. "Group Influence on Creativity in Mathematics," Journal of Experimental Education. Vol. 31, March 1963, pp. 257-363.

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Osborn, A. F. Applied Imagination. New York: Scribners, 1963.

Parnes, S. J. and Meadow, A. "Effect of 'Brainstorming' Instruction on Creative Problem-Solving by Trained and Untrained Subjects," Journal of Educational Psychology, Vol. 50, August, 1959, pp. 171-176.

Parnes, S. J. Instructor's Manual for Semester Courses in Creative Problem Solving. Buffalo: The Creative Education Foundation, 1963.

V. Materials

Instructor Guide

Transparencies

#1 Application of Deferred Judgment

#2 Good Uses for a Paper Clip

#3 What can we do to help visitors from overseas. . .?

#4 Uses for a Man's Belt

#5 Group Ideation

#6 Judgment-Oriented Ideation

#7 Rules for Brainstorming

#8 How can we learn more about people in foreign lands?

Overhead projector and screen

Grease pencil

Pad and pencil for each student

Post-presentation handout for each participant

VI. Procedure

A. Introduction

1. Display Visual #1 which states the title of the module

2. Ask students to participate in two brief exercises which will help to clarify the discussion to follow

a. Individual ideation exercise

(1) Display Visual #2

b. Group ideation exercise

(1) Display Visual #3

3. Post idea production scores for later comparison.

B. Discuss principle and procedure of deferred judgment

C. Individual application of deferred judgment

1. Display Visual #4

D. Discuss group approach to deferred judgment

1. Display top half of Visual #5

2. Display lower half of Visual #5

3. Comparison of judgment oriented and deferred judgment idea production situations

a. Display Visual #6

b. Discuss brainstorming

(1) Display Visual #7

E. Group application of deferred judgment

1. Display Visual #8

F. Display and compare judgment oriented ideation to deferred judgment ideation

1. Number of ideas produced under each

2. Remind groups of comparability of idea production situations

3. Remind group of major difference between idea production situations

4. Ask students which set of ideas they'd rather use as a source for the best idea.

G. Summary

1. Two types of idea production situations.
2. Demonstrated efficacy of deferred judgment idea production over judgment oriented idea production.
3. Distribution of student hand-outs.

VII. Further Comments

The omission of any precise statement of this module's objectives in the script is no accident. This omission, like the cryptic wording of the title, is intended to set the stage for an experimental atmosphere. To successfully achieve the objectives of this module the user should share in the experimentation. The instructor's familiarity with the script is also critical, as is his personal acceptance of the module's objectives and the theory on which it is based.

Judicious use of time is a must if this module is to be completed in one 50 minute period, and the instructor must supervise the investment of class time carefully. If time does run unavoidably short, the last segment of the module, immediately preceding the summary, can be omitted, but such action is not advised.

Desired Learning Outcomes	INSTRUCTOR BEHAVIOR	Student Behavior
Students will demonstrate increased ability to create new and useful ideas.	Project Visual #1 Ask the class to participate in two brief exercises which will help to clarify the discussion to follow.	Agree
A. Demonstrate deleterious effects of prejudgment of ideas.	1. Ask students to take paper and pencil.	1. Take out paper and pencil.
	2. Tell them; "I'm going to ask you for your ideas regarding a question. You will be given a limited amount of time to list these ideas. In answering this question, list only <u>good</u> ideas. Don't put down any idea unless you actually feel that it is a <u>good</u> one. I cannot answer any questions once I state the task."	2. Listen and understand that they are to list as many <u>good</u> ideas as possible in the time provided.
	3. "Please list all the <u>good</u> uses you can think of for an ordinary paperclip,--other than for clipping pieces of paper together."	3. Decide whether an idea is good or not and then list it.
	Project Visual #2 Repeat; "Please list... You will have 3 minutes."	
	4. At end of 3 minutes, have class put their idea lists to one side.	4. Put idea lists to one side and wonder what we did this for.
	---	---
	<u>Group Ideation Exercises</u>	
	1. Ask class to form into groups of about 6 and elect chairman and secretary for each group.	1. Form into six persons per group and elect chairmen and secretaries.
	2. Ask secretaries to keep record of all of the ideas forthcoming from his group.	2. Listen
	3. Tell class that the president has decided to reinstate the Visit-the-United-States-of-America-Program that was originally established during the last Eisenhower administration.	3. Listen

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
Demonstrate ability to create new and useful ideas. A. Deleterious effects of prejudgment (con't.).	4. "Here's your question. As groups, you are to compile lists of suggestions about What We Can Do To Help Visitors From Overseas to Understand and Appreciate Our Country. Project as Visual #3 Repeat the question.	4. Know that they are to compile their lists of suggestions to answer the question.
	5. Stop groups at end of 5 minutes.	5. Stop group work.
	6.. Ask secretaries for idea totals.	6. Provide number of ideas.
	7. Post idea totals for later reference.	7. Read idea totals.

	<u>The Principle of Deferred Judgment</u>	
	1. Ask: "What do you suppose would happen if you freed yourself of all fear of any possible criticism or reaction of others to your ideas and also freed yourself of any adverse reaction to your own ideas?	1. Listen and consider.
	2. Let's put this to the test and see just what happens.	2. Be ready for some activity.
	---	---
	<u>Individual Application of Deferred Judgment</u>	
	1. "Please take another piece of paper and individually participate with me in another experiment." [Make the following statement verbatim]	1. Take paper and pencil and be ready.
	2. "I'm going to ask you for ideas regarding another question. You will again be allowed a limited time to list your ideas. Is everyone ready?	2. Know that they are expected to list all ideas.

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
	In answering this question, you are requested to adopt a particular type of thinking. You are to list <u>all</u> the ideas that you can think of <u>without judging them in any way</u>. Forget about the quality of the ideas entirely. We will count only quantity on this task. As you go along, you may combine or modify any of the ideas which you have already listed, in order to produce additional ideas. Remember that quantity and freedom of expression, <u>without evaluation</u>, are called for.	List all ideas without prejudging them. Only quantity counts. Free to combine or modify ideas.
	No one else will see your papers.	
	I cannot answer any questions once I state the task. The task is this: List all the uses you can think of for a man's belt other than for holding up pants. You will have 3 minutes.	List all uses for a man's belt.
	Project as Visual #4	
Demonstrate ability to create new and useful ideas. Adapt principle of deferred judgment (con't)	3. At end of 3 minutes, tell participants to stop writing and say, "now let's compare your "belt list" to your "paper clip list". "How many thought up more ideas this time than last time?" "How many find your ideas more interesting and potentially more valuable under the'free wheeling' situation than under the'good ideas only'situation. [Total time to this point should be 25 minutes]	3. Stop writing and compare lists. Should all find more on last set.
	4. If evidence of efficacy of non-judgmental ideation is not clear at this point, cite research findings. A. Research at State University of New York at Buffalo (SUNYAB) shows that students consistently produce more ideas when following the principle of deferred judgment. B. Twice as many good ideas per individual is the average. C. Best ideas occur during last half of total ideas. (78% more) Deferring judgment = diamonds-in-the rough.	4. Should agree that evidence is in favor of deferred judgment.

Group Approach to Deferred Judgment

1. Say, "Now let's think back to our previous attempt at producing ideas in groups.

How many of you heard an idea expressed that you hadn't thought of yourself?

Appreciate reasonableness of application of principle of deferred judgment to group problem solving efforts.

How many thought of a new idea as the result of something someone else said?

Display top half of Visual #5

A. Each circle could be taken as representing an individual's knowledge and experience

A. Visualize conference situations.

Display lower half of Visual #5

B. Ideally, in a group problem solving situation, this kind of thing would occur but doesn't because judgment predominates.

B. Agree that "B" is more desirable than "A" and wonder why it doesn't happen more often.

Display Visual #6

Read

Agree on limitations of judgment-oriented approach to idea production.

Read Visual #6 to class.

2. "In judgment-oriented idea production situations, people:

A. Think of reasons why their own ideas won't work and keep quiet to avoid displaying their ignorance.

B. Find fault with ideas that are proposed.

C. Rigidly defend their original ideas.

D. Enter into numerous side debates and discussions."

3. Let's apply our discoveries about individual idea production to the group idea production situation.

3. Listen and agree

4. Say, "One of the better known approaches to judgment-free idea production is called brainstorming."

4. Listen

Display Visual #7, Rules for Brainstorming.

Read

Read rules to class.

Listen and agree.

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
	A. Criticism is ruled out. Judgment is suspended until subsequent evaluation. B. Free-wheeling is welcomed--The wilder the ideas, the better; ideas are easier to tame down than think up. C. Quantity is wanted. The greater the number of ideas, the more the likelihood of good ones. D. Combination and improvement are sought. In addition to contributing their own ideas, participants should feel free to suggest improvements in ideas stated by other participants or to combine more ideas into a still better idea.	
	5. Tell class, "Brainstorming is quite difficult at first because of our long term critical habits, so, during our next experiment, I'm going to leave the "rule display" up and listen in on your different groups to help you stay within the rules of the game."	5. Listen and agree.
	Group Application of Deferred Judgment	
	1. Say, "Let's apply brainstorming to another 'International Understanding' problem. Remember, 50 ideas in 5 minutes is the usual score for SUNYAB groups like yours, with about the same level of experience.	1. Listen and agree. Be aware of performance expectations.
Demonstrate that the elimination of pre-judgment in idea production enables the group to produce many more ideas.	2. Remind the secretaries that they are to record only the number of ideas; that what we're trying to find out is how many ideas we can produce.	2. Listen and reaffirm their awareness that we are after volume production of ideas.
	3. Tell students that their problem is "to think up ways to help us learn more about people in foreign lands." A. Display Visual #8 "What ways can we think up to help us learn more about people in foreign lands." B. Read visual to class.	3. Be aware of what they are to do and how they are to do it.

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
	4. Tell groups to "begin."	4. Begin ideating.
	5. Leave Visual #8 up before the groups.	5. Read problem and method of developing ideas to solve it.
	6. At end of 5 minutes, remove Visual #8 and call "time."	6. Stop
	7. Ask secretaries to report the number of ideas produced by their groups.	7. Secretaries will report totals; members will compare results.
	---	---
	<u>Compare Judgment Oriented Ideation to Deferred Judgment Ideation</u>	
Students should be confirmed in their success in producing a greater number of ideas in the DEFERRED JUDGMENT idea producing situation.	1. Compare previous group ideation totals to this last effort. (Last should be greater.)	1. Note that greater number of ideas was produced in latter exercise.
	2. Remind group that the two situations were virtually identical; Same groups Same officers Same period of time Comparable problems. Only difference was that in the second exercise they had been given a brief introduction to the brainstorming approach to the elimination of pre-judgment in idea production.	2. Listen and agree that their own conscious attempt to eliminate pre-judgment from the idea producing process was the only significant difference between the two exercises.
	3. Remind group that repeated controlled experiments elsewhere demonstrate that the DEFERRED JUDGMENT approach produces more ideas.	3. Agree that DEFERRED JUDGMENT ideation does(or should) produce more ideas.
---	---	---
Students should become convinced that ideation without pre-judgment produces better quality (personally assessed as more useful ideas.)	1. Ask students which set of ideas they would rather work with if they actually had the responsibility of suggesting useable solutions to both of the problems.	1. Should choose the ideas produced under DEFERRED JUDGMENT conditions.
	2. Tell them that test groups conducted elsewhere also preferred the ideas developed under DEFERRED JUDGMENT conditions.	2. Be confirmed in their belief in DEFERRED JUDGMENT idea production.

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
Students should appreciate the fact that training and practice in DEFERRED JUDGMENT ideation improves both quantity and quality of idea production.	1. Say, "Now let's try one more exercise to demonstrate one final point. Let's take the list of ideas you produced earlier regarding uses for a man's belt. Draw a line under the last idea you had on the list. Now let's see how many more ideas you can add in another 3 minutes.	1. Pick up "belt use idea list", draw line under last item, and be ready to add to it.
	2. Say, "OK, go."	2. Begin, noting ideas.
	3. At end of three minutes say, "Time is up."	3. Stop writing.
	4. Ask for total of ideas produced in this last 3 minutes.	4. Tell totals.
	5. Ask for show of hands to indicate how many prefer their last ideas to their earlier ones.	5. Most should agree that their later ideas are preferrable to their earlier ones.
Students should be confirmed in their belief that: 1. pre-judgment reduces their idea producing capabilities.	1. Say, "Today you have practiced idea production in two ways: A. The way you usually do it, which probably involves considerable pre-judgment, and B. In a way that involves the practice of DEFERRED JUDGMENT. You have performed both types of ideation as individuals and as groups.	1-4 Listen and agree.
2. application of the principle of DEFERRED JUDGMENT improves both the quantity and quality of ideas produced.	2. The scores of these exercises show that you produced more ideas under the DEFERRED JUDGMENT situation.	
3. idea production through the application of the principle of DEFERRED JUDGMENT can be taught.	3. Your choices of ideas you'd rather try to implement indicate that you find the ideas developed under the DEFERRED JUDGMENT situation to be superior to the ones you produced in situations where you allowed pre-judgment to inhibit your creative capability.	
	4. You have demonstrated, in our last exercise, that the production of more and better ideas through DEFERRED JUDGMENT can be taught.	

RECOGNIZING THE REAL PROBLEM

RECOGNIZING THE REAL PROBLEM

Introduction

I. Introduction

The ability to solve problems is man's greatest advantage over lower life forms. Man's reasoning power enables him to solve complex physical and non-physical problems and sets him apart from other livings things. Unfortunately, much of this unique faculty is wasted through man's inability, or perhaps reluctance, to develop his problem solving capabilities to their fullest.

This module begins with an early phase of the problem solving process, that of achieving a productive definition of the problem or problems to be solved. At the conclusion of this module, it is expected that teachers will:

1) be more adept at recognizing and dealing with their everyday problems, and

2) be able to communicate this skill to their students by that strongest of teaching methods--example.

This module is designed to develop an awareness in the user that:

1) problems are opportunities for creative people

2) problems must be correctly defined to be solved

3) they can achieve more productive definitions to problems by using the techniques demonstrated in this module.

II. Operational Objectives

At the conclusion of this module, the participants will have:

1) agreed to the necessity of looking for problems in their everyday work situations

2) recognized some of the mental outlook "sets" which inhibit

peoples' problem defining and problem solving capabilities.

3) applied a number of problem defining approaches to both primary and secondary problem situations.

4) demonstrated their acceptance and understanding of these problem defining methods by the increased number of suggestions they offer and the rate with which these suggestions are presented.

III. Rationale

Labeling the age in which we live as "The Age of Change" might be somewhat presumptuous since it implies that the world of 10, 20, or 100 years in the future will be less problematic than this one. Certainly, we can claim that there is more change today than there was yesterday, that today's problems are more complex than ever before, and that the complexity of our problems can be expected to increase with the passage of time. Hence, it is in our interest to refine our problem solving methods in the direction of efficient use of resources and time.

The purpose of this module is to improve the participants' problem solving capabilities by improving their ability to define problems in ways which are more susceptible to productive solutions than the probable methods they have been using heretofore.

IV. References

Hyman, R. "Creativity and the Prepared Mind: The Role of Information and Induced Attitudes." In Taylor, C. W. (ed.), Widening Horizons in Creativity. New York: Wiley, 1964.

Osborn, A. F. Applied Imagination. New York: Scribners, 1967.

Parnes, S. J. Creative Behavior Guidebook. New York: Scribners, 1967

V. Materials

Instructor Guide

Scratch pad and pencil for each participant

Box-type wastebasket

Can of beets with top bent (top is upper end when label is easily readable)

Can opener

VI. Procedure

A. Introduction

1. "One Big Mess" example

2. Lectern Exercise

3. Barrel-weighing exercise

B. Finding the Real Problem

1. Redefining by asking "why?"

a. Tape-winding example

b. Outdoor grill exercise

2. Redefining by changing verb

a. Bread-toasting example

b. Car parking example

3. Broadening the problem -- review

a. Arnold -- state problem broadly

b. Einstein -- essential to formulate problem

c. Church painting example

4. Wording the problem more effectively

a. Firing the worker

b. "Should he enlist?" exercise.

C. Summary

1. "Mess" to "Broad Problem" to "Sub-Problem"

2. Looking for problems, redefining, wording for ideas

3. Broadening by asking "why?" and changing the verb

VII. Further Comments

A reading of the Instructor's Guide will reveal that much of the content is in form of anecdotes and guided analysis. Thus, much depends on the instructor's familiarity with the content, the module's objectives, and his storytelling ability. The primary problem situations (the rostrum and beet can examples) are positioned relative to the rest of the module to assist the instructor in making the participants feel that they are part of the anecdotal situations. Above all, the participants should be involved in the experiment as much as possible, and it is the instructor's business to help them do so.

Desired Learning Outcomes	INSTRUCTOR BEHAVIOR	Student Behavior
1. Students will appreciate the importance of looking for problems in their everyday situations.	1. Tell the "Big Mess" story. "Once upon a time not so very long ago, there was an instructor in a well-known Eastern college who used the problem solving approach in teaching his students to become junior administrators. One day one of his former students, who had recently completed the course, came to see his old instructor. Naturally, his old teacher was glad to see him and asked him how he was doing. The student replied, "I've been fired. After taking your course in problem-solving, I was well prepared. If they'd only given me some problems to solve, I could have licked them with no trouble at all. But they didn't give me any problems; all they gave me was one devil of a mess." A. Ask students to explain the meaning of the story. B. Follow-up with "Why do you think this story was included at this point in the module?"	A. Should say that the story is a parable or an object lesson whose point is that most problem situations are messes and that problems must be defined before they can be solved. B. Should say that it probably indicates the direction that the remainder of this module is going to take.
2. Students should know that this module is designed to help them improve their problem solving capabilities by helping them to arrive at more realistic problem definitions.	2. Summarize studerts' statements to the effect that they have proposed that problems must be defined before solutions can be sought and that the objective of this module is to assist them in the problem definition dimension of their problem solving efforts.	2. Be aware of module objectives.
3. Students should agree that we must look for problems if we're going to start defining or solving them.	3. Tell students that another major point of the preceding story was the importance of being sensitive to the existence of problems; that messes are made up of one or more problems. Unlike the young man and his "devil of a mess", we should learn to look for problems.	3. Listen and agree.

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
4. Students should be reaffirmed in their agreement as to the importance of defining the problem to the development of an acceptable solution, and further, recognizing that the statement of a problem frequently dictates the solution.	4. Say, "Now while we all agree that it is highly desirable for us to increase our sensitivity to the existence of problems, we also know that many of the problems we have to solve are thrust upon us unexpectedly. Let's all assume that we've been invited to speak at a meeting much like this and discovered that there was no rostrum in the room.	4. Listen and agree to summary and participate in the stated problem situation.
	A. "It doesn't take much sensitivity to recognize that problem, does it?"	A. Should demonstrate that they recognize the problem.
	B. "What is the problem?"	B. A variety of responses should occur, like "need to find another rostrum, do without, find something to put the notes on.
	C. Point out that most of their statements of the problem were actually suggested solutions and that the real problem is that the speaker feels uncomfortable without something to put his notes on.	C. Listen and agree.
	D. Ask "Does redefining the problem this way help us by pointing out previously unexpected solution possibilities."	D. Should agree that it does.
	E. "O.K., now let's talk about solutions. What would you do, if you were confronted with the missing rostrum situation?"	E. May repeat previous solutions.
	F. If students suggest using the wastebasket, agree with them. If they fail to note this solution, suggest it. Then use wastebasket as a rostrum.	F. See that wastebasket performs the function of a rostrum very well.

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
	G. Ask students if they would have thought of the wastebasket if the problem had been limited to finding a rostrum.	G. Should agree that they would not have.
	H. Point out that the basic step to solving this problem when we decided that what we wanted to do was to find a way to position our notes a little higher than the table top. The real problem was not to find a rostrum but to find a way to perform the function of a rostrum. As John Dewey once said, "A problem well-defined is half-solved."	H. Should agree
5. Reaffirm students' awareness of the importance of defining the problem.	5. Let's try this same procedure to another problem. "A chemical company was once faced with the problem of determining the weights of barrels of gunpowder in order to calculate freight charges. The barrels were so heavy that three men were needed to lift them onto the scale. The management considered several solutions such as lowering the scale, building a ramp, using pulleys, etc. Finally, it was decided to start at the beginning and look for the actual problem." Originally the challenge had been worded, 'In what ways might we get barrels on the scale?' or 'How might we get the scale under the barrels easier to handle?' When management asked, 'Why do we want to get the barrels on the scale?' the answer was, 'To determine their weight.' This was followed quickly by another 'why' question, 'Why do we want to know the weight of the barrels?' and the answer to that was 'so that we can determine the shipping costs.' The problem was then restated as 'In what ways might we determine the	5. Listen and consider

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
	frieght charges?' With this restatement, they realized that they could establish standard weights for filled barrels of various sizes. Thereafter, the barrels did not even have to be weighed.	
6. Recognize the implicit 'Why' question in both of the preceding problem solving approaches.	6. Ask students, "Do you all understand the implicit 'Why' question in the last two problem solving situations? 'Why?' or 'What is my basic objective?' 'What am I really trying to accomplish?' is a key question in attempting to evolve an adequate solution of a challenge or a problem. We will often reach the basic definition of a problem if we keep asking the simple question 'Why?' We must ask 'Why?' Why do we want to find the answer to the problem as we have stated it? The answer to that question will usually give us the foundation for a new, more basic solution to the problem."	6. Listen and agree.
7. Be reaffirmed in their acceptance of the utility of the 'Why' approach to finding the basic problems.	7. Say "Another real-life experience of the efficacy of the 'Why' approach to problem definitions was found in the 'tape-winding' problem. The management of the company concerned was trying to find a faster way to wind tape around the end of a metal rod (like taping the end of a baseball bat.) After considerable progress had been made in cutting down the time and effort required for the job, someone innocently asked--why tape the rod? The foreman didn't know. Neither did the engineering department. But it did become curious enough to look back to the original specifications. When they did that, they discovered that the original rod material had been replaced some time ago by a	7. Agree that someone's asking the 'Why' question totally eliminated the problem in this case.

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
	new material which made the taping unnecessary. The answer to the last 'Why' question had eliminated the entire problem."	
8. Gain experience in applying the 'Why' asking approach to a number of problems.	8. Tell class that you are "going to give them some problem statements and that you want them to broaden these statements, by asking and answering the 'Why' question, into more basic statements of the problem."	8. Evolve broader statements of problems by applying the 'Why' approach.
	A. "In what ways can we make a better mousetrap?"	
	1) Wait for participants to supply answer.	1) Answer, such as "To catch mice more effectively."
	2) Ask them to make a broader restatement of the problem by asking 'Why?' again.	2) Answer with something like, "In what ways can we rid our homes of mice?"
	3) Compliment participants on their acuity and suggest applying the same problem broadening 'Why' asking procedures to a new problem.	
	B. Apply same procedure to new questions. "In what ways can we improve the outdoor grill?" Compliment participants again and proceed to another problem statement and apply the 'Why' asking procedure once more.	B. This should result in restatements like; "In what ways can we better enjoy out door cooking...cook better outdoors...improve outdoor cooking and eating?"
9. Gain experience in overcoming mental set by changing the verb in the original problem statement.	9. Show can opener and can of whole beets with bent top to group. Ask them to write down their solutions to the problem in one minute.	9. Write down their solutions.
	A. Ask how many thought of turning the can over and opening the bottom of the can.	A. Some should indicate that this had not occurred to them.
	B. Tell class that this is one example of mental set; one of our little life habits that we seldom question.	B. Should indicate general agreement.
	C. Tell class that one of the more effective ways of overcoming the mental set problem is to change the verb in the problem statement.	

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
	1) "Thus, how to open the can might become how to remove the beets from the can?"	
	2) "Using this same approach, how to toast bread might become what?"	2) Offer restatements like "How to brown and dehydrate bread."
	3) "How about how to park cars?"	3) "How to store cars."
	B. Ask participants if they can see how a restatement of this last problem to "How to store cars" could have led to several new car storage designs that presently exist.	B. Should indicate general agreement that such mental problem restructuring had something to do with the developments.
10. Be reaffirmed in their acceptance of the importance of broadening problems to the production of new insights and solutions.	10. Tell group..."John Arnold, late professor of creative engineering once put the matter of broadening the problem this way: 'Knowing what you are looking for helps you to recognize it when you see it. But in the case of innovation, how do you know what you are looking for? You don't unless you have stated your problem so broadly, so basically, so all inclusively and generically that you do not preclude even the remotest possibilities--so that you do not pre-condition your mind to a narrow range of acceptable answers.' Albert Einstein was talking about the same thing too when he said, "The mere formulation of a problem is far more essential than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from new angles requires creative imagination and marks real advances in science."	10. Listen and agree.
	11. Say "let's apply the 'why asking approach' to problem broadening to another real life situation."	11. Listen and consider

"A small church congregation of limited financial means faced the problem of repainting its historic old frame church in time for its centennial celebration. To keep the costs down, the men had volunteered to do the painting during their spare time. Many weeks later, with the anniversary date fast approaching, very little had been done. It became evident to the harassed repair chairman that he would have to act fast."

A. Tell participants to give their interpretation of what the challenge was and to begin each statement with "How to", or "Ways to" and to keep asking themselves "Why" to get at more basic aspects.

A. Offer restatements like: "Ways to get... the men started." ...fulfill pledges. ...the church painted in time...make the church more attractive for the centennial...strengthen the impact of the church on the community."

B. Compliment the group for their efforts and tell them that the actual approach chosen by the chairman was "Ways to get the men started," but all of the other ideas helped him to achieve the overall result he was after by restating it in so many ways.

12. Be able to recognize the difference between decision finding statements of problems and idea finding statements of problems and to appreciate the value of the latter in finding better solutions to problems.

12. Tell the group that we're now going to consider another aspect of broadening of a challenge--wording it in a way that is conducive to idea finding. "The foreman in a plant found that one of his workers was proving to be unsatisfactory. He therefore was considering the dilemna 'Should I or shouldn't I fire the worker?'

Probably neither of these two alternatives was completely satisfactory to him; otherwise there would be no question in his mind.

As John F. Kennedy once said "We intend to have a wider choice than humiliation or all-out nuclear war."

To have a wider choice than "fire or don't fire", the foreman must restate the challenge in a way that will permit him to consider many more possibilities.

12. Listen,

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior
	NOTICE THAT THE FOREMAN'S QUESTION, "SHOULD I FIRE THE WORKER?" IS WORDED FOR <u>DECISION FINDING, NOT FOR IDEA FINDING</u>. If we ask "why" we should fire the worker, we might answer, 'He's not producing well; he is indifferent, etc.	
	A. WHAT MIGHT BE A NEW WAY OF RESTATING THE PROBLEM ON THE BASIS OF THIS ANSWER TO OUR QUESTION'WHY'?	A. Offer restatements like: "How might I get the worker to produce effectively and cooperatively?" "...overcome his indifference...get him interested...encourage him to do better?"
	B. Suggest that we broaden the challenge still further by asking, "In what ways can I get this worker's job done effectively and cooperatively?"	B. Listen and agree.
	C. Ask group if they agree that this and their own statements might be more accurately classified as <u>idea finding</u> statements?	C. Should indicate agreement.
13. Demonstrate recognition of a decision finding statement which can lead to more productive solutions to the original problem.	13. Suppose you are confronted with the problem of whether or not your son should enlist in the armed forces.	13. Listen.
	A. Ask, "How would you phrase this problem into a <u>decision finding statement</u>?"	A. Offer "Should my son enlist?"
	B. Say "OK, now rephrase this statement into an <u>idea finding statement</u>.	B. Offer: "In what ways might he prepare for his military obligations and look beyond?" "..get the most out of a hitch in the service...learn the advantages and disadvantages of enlisting ...serve both his country and himself?"
	C. Agree.	

Desired Learning Outcome	INSTRUCTOR BEHAVIOR	Student Behavior

SUMMARY

14. Tell group how much you've enjoyed working with them.

14. Listen, agree and remember.

A. Tell them we've covered some major aspects of problem definition that will enable us to arrive at more imaginative and productive solutions to the problems we face every day.

1) I think we all recognize the importance of looking into the "messes" that confront us at every turn for problems to be solved.

2) I think we are all aware of the big picture advantages or, "view from the mountain top" to be gained by broadening our problem solving abilities.

B. Remind the group of the ways which we used to set up our problems so that more creative and productive solutions were possible.

1) Defining the "real" problem (wastebasket example)
2) Broadening by asking 'Why?'
3) Broadening by asking "What is my basic objective?"
4) Broadening by changing the verb.
5) Restate questions from <u>decision finding form to idea finding form</u>.

C. "But I think the most important thing that's happened here today is that we've taken this brief opportunity to look at a number of problem situations as challenges to our creative imaginations.

DEVELOPING THE SOLUTION

INSTRUCTOR'S GUIDE

DEVELOPING THE SOLUTION

Introduction

Education is many things to different people. Indeed, it is often many things to the same person, depending on the particular aspect he has in mind or behavioral goal that he visualizes as being best achieved through the schools. One of the more widely accepted goals of education is that it should prepare its students to solve problems, particularly those problems that they will encounter in life once they have left the classroom.

The schools, however, do not always teach children to develop individual, creative problem solving techniques but rather to apply the solutions that are currently being taught to whatever problems may occur. Teachers are inclined to teach the way they were taught or were trained to teach. Consequently, they apply the same solutions to whatever problems arise but are surprised when the results fall short of their expectations.

This module is directed toward discouraging the application of ineffective solutions to today's problems. Instead, it emphasizes the development of ideas from the present situation and the evaluation of those ideas against carefully defined criteria. The procedures outlined here are not considered to be the final word on the subject but have been found to be effective solutions to practical problems in a variety of situations. Like all tools, "the method" can be further refined, and both the instructor and the students who use this module are enjoined to improve it to suit their particular circumstances.

I. Goals

As outcomes of this module, it is expected that teachers and prospective teachers will:

1) have demonstrated their ability to apply Creative Problem Solving procedures to everyday problems,

2) be sufficiently experienced in the application of these procedures to apply them to their classroom situations, and

3) be able to communicate the requisite attitudes and skills to their students, by example.

II. Operational Objectives

At the conclusion of the presentation of this module, it is expected that teachers and prospective teachers will have:

1) utilized the "problem definition" and "deferred judgment" skills learned in previous modules,

2) demonstrated their ability to use creative problem solving procedures to solve real problems,

3) internalize creative problem solving procedures into their approach to the teaching situation.

III. Rationale

The previously treated breakdowns of the creative problem solving process, while useful both as approaches to situations and as guides to more creative attitudes on the part of teachers and prospective teachers, require a "tie-up" which makes productive use of this process. The choice of problems outside the field of teaching as the device for their learning of this method is designed to encourage participant "detachment" from the

problem situation so that the method is learned rather than the solution or solutions that would be derived if problems from the participant's own experience were used.

A final module in this series is planned to achieve this end; applying the creative problem solving process to life problems.

IV. References

Osborn, A. F. Applied Imagination. New York: Scribners, 1967.

Parnes, S..J. Creative Behavior Guidebook. New York: Scribners, 1967.

V. Materials

Instructor's Guide

Blackboard

Scratch pad for each participant

Copy of Student Text for each participant

Extra copies of blank problem solving worksheet

VI. Procedure

1. Post the learning goals cited on page 29, Item I, of the Instructor Guide.

2. Have participants examine the first set of problem solving worksheets and note places where deferred judgment thinking is desirable and places where judgmental thinking is needed.

3. Have participants quickly list 5 phases of creative problem solving on a piece of scratch paper without reference to the student text. Correct.

4. Have participants turn to page 47 (page 32 of Instructor's Guide) and read the statement of the "bus problem".

5. Have participants solve the bus problem as group or groups.

6. Compare results.

7. Have participants turn to statements of the crib problem and read.

8. Have participants list the 5 phases of the creative problem solving method.

10. Compare "crib problem" application of method to the "bus" problem applications.

11. Summarize by referring participants to learning goals cited and asking them to decide if these goals have been achieved.

VII. Additional Comments

Optimum success in presenting this module will depend on the instructor's familiarity with the process and his conviction regarding its efficacy.

Steps 2, 3, 8, 9, and 10 are included as aids to securing participant familiarity and conviction but cannot replace the instructor's ability to guide the group to the achievement of the objectives.

What should the bus driver do?

On a public bus the driver can eject rowdies. On a school bus he cannot do this and must deliver the children safely no matter how badly they behave. On one school bus, an eight-year-old boy struck and bit other children and kept the entire bus load in a noisy, confused state. Due to the disturbances, the driver nearly had several accidents. He pointed this out, but the boy jeered and continued behaving in the same way. When the boy's victim complained, the school principal tried to punish the rowdy by keeping him in the office during recess. This had no effect, nor did appeals to his parents. The driver reported that he was as bad as ever but was cautioned by the principal that anyone who spanked him might be sued or prosecuted.

Solution Development Worksheet -- Part 1

I. Fact Finding

Concentrate on column 1 first; then go on to columns 2 and 3.

Column 1	Column 2	Column 3
What other facts would you like to have about the problem? (List fact-finding questions, not judicial or creative ones. Don't worry about whether or not you can get the information; if you would like to have it, raise the question)	Where might the answers to the most important questions be obtained? List all conceivable sources of information.	Using the best sources, find the answers to the most significant questions and fill them in below
1. Does he have personal or family problems that might account for his actions?	a. parents b. principal c. school psychologist d. teachers e. other boys etc.boy himself	No abnormal problem Parents are very permissive in their manner of raising children
2. How does he act in the school building?	a. school psychologist b. principal c. teachers d. custodian e. other boys etc.	No serious misconduct reported in the school building
3. What are his special interests?	a. boy himself b. parents c. psychologist d. gym teacher e. other boys etc.	Interested in most sports, particularly baseball
4. Does he have any friends among his peers?	a. b. c. d. e. etc.	
5. When did he start acting this way?	a. bus driver b. teacher c. other boys d.' e. etc.	From the first day this year
	a. b. c. d. e. f. etc.	

Use as many pages as you need to list all the questions you would like to have answered. When you have exhausted your supply of questions go back and circle the most important questions.

Go back and circle the best sources.

II. Problem-Finding

List all the creative type questions (problems or challenges) suggested by the problem. ("How might I...? In what ways might I...?, What ideas might I produce to...?, etc.) If "fact-finding" or "judicial" type questions occur to you, convert them to "creative" types by restating them as "How might I find out...?" or "How might I decide...?"

Note the number of problems of this type that are suggested by the "situation" and the additional facts you have been able to gather about this situation.

1. How might I settle this boy down?

2. How might I make the parents more responsible?

3. How might I isolate "problem children" from the others?

4. In what ways might I make such children more responsible?

Stop a moment and ask, "What is the real problem?" "What is my basic objective?" "What do I want to accomplish here?" Ask "WHY?" of each problem you have listed. ("Why do I want to do this?") In asking these questions of yourself, try to restate and broaden your problem. For example, asking "Why?" of the problem, "How might I catch the mouse?" could lead to the restatement, "How might I get rid of the mouse?" Try to find problem statements (questions) that give the largest number of possible approaches. Try paraphrasing and finding synonyms in your problem statement.

5. How might I maintain order on the bus?

6. How might I achieve peace on the bus?

7. How might I provide a safe and sane ride?

Now that you have broadened the problem, what other reactive aspects or approaches (sub-problems) can you see that you didn't list earlier?

8. How might I make the bus ride more interesting?

9. How might I get rid of this particular child?

10. How can I get other children to discipline this boy?

Now circle the best, most promising problem statement from all that you have listed. Perhaps it is the one that will give you the greatest leeway, the largest number of approaches or areas for exploration, -- the one that includes most of the other ones (sub-problems). Or it may be one of the narrower statements that is really the crux of the situation. In any event, choose the one which is the most significant to you.

NOTE: You may want to go back and carry out additional fact-finding on the first part of this worksheet, now that you have restated your problem. With the new wording, you may be able to list many more facts now.

Solution Finding Worksheet -- Part 3

III. Idea Finding (deferred judgment)

Problem Statement: (Selected from Part II) How might I maintain peace on the bus?

Be sure your problem statement is clear, concise as a telegram; also be sure it starts with words like, "What ways might I...?" or "How to...?"

IDEAS (tentative leads to solution) Use any of the sub-problems previously listed as approaches to spur ideas. The following list of idea-spurring questions may also prove effective in helping to generate ideas.

OTHER USES? SUBSTITUTES? ADAPT? MODIFY? MAGNIFY?
MINIFY? REARRANGE? COMBINE? REVERSE?

1. Get trouble makers expelled from school.
2. Don't let this boy on the bus (make parents transport him).
3. Get one of boy's parents to ride with him.
4. Equip bus with seat belts.
5. Have teacher assigned to bus to keep order.
6. Separate this boy from other children.
7. Punish all children whenever someone "acts up".
8. Have the children decide what to do with troublemaker.
9. Appoint the boy as monitor to keep order.
10. Have children study during bus ride.
11. Rearrange bus route so that boy is picked up last and dropped off first.
12. Ask for more authority to handle problems.
13. Provide books and magazines of interest.

Now go back and circle the ideas that seem to offer the best potential (judgment).

NOTE: If your original problem statement was quite broad, you may find that many of the ideas you list on this sheet may actually be sub-problems. For example, consider the problem, "How might I increase sales in this territory?" You might list such ideas as, "obtain more customers," "step up advertising," etc. In cases like this you would choose one of these "approaches" at a time and then probe for more specific ideas. ("How might I obtain more customers?", "How might I step up advertising, etc.) In such cases you will want to repeat this worksheet (using one of the more specific sub-problems as the problem statement each time) and follow all subsequent worksheet procedures for each of these approaches or as many as you deem worthy of development to this extent.

Solution Development Worksheet --- Part 4

IV. Solution-Finding

Evaluation Criteria: What are the yardsticks by which you can mentally test the effectiveness of each of your ideas? These criteria are really a further measure of your sensitivity to problems; problems that might be implicit in changes that would be brought about by each idea. Try to anticipate all effects, repercussions, and consequences. (Look over your facts on the Fact-Finding portion of this worksheet for leads to important criteria.)

	CRITERIA													
	EFFECT ON OBJECTIVE	EFFECT ON BOY	EFFECT ON CHILDREN	SCHOOL POLICIES AND LAWS	COST IN TIME, MONEY, ENERGY					USE NOW	HOLD	REJECT	MODIFY (HOW?) To overcome poor rating	CHECK DECISION BELOW
1.														
2.	3	3	3	1	2						X			
3.	2	1	1	2	1						X			suggest all mothers take turns riding
4.														
5.	3	2	2	2	1					X				
6.	2	1	3	2	1					X				
7.	2	2	1	1	2				X					combine to motivate others to control boy
8.	3	3	3	2	3				X					
9.														
10.														
11.	2	2	3	1	2					X				
12.														
13.	2	3	3	2	2					X				ask school board, ask librarian, ask students
14.	2	3	3	3	2				X					
15.														
16.														
17.														

Line up the left margin of this part of the worksheet with the ideas you have listed on Part III. Evaluate the ideas you circled as having the best potential. For each of these ideas, indicate a rating in each block---e.g. 3(good) 2(fair) 1(poor) DP(doesn't pertain) etc. Then make a decision regarding each of the circled ideas (based on its rating under the various criteria) by checking or commenting in one of the boxes under "Decision."

V. Acceptance-Finding

NOTE: This procedure is designed to help you use creative thinking in preparing to put an idea into effect.

Write idea to be developed here:

Motivate children to discipline the troublemaker.

DO NOT FILL IN THESE COLUMNS UNTIL FINISHED WITH THE FIRST COLUMN (see bottom of page)

Column A Ways of implementing, carrying out, accomplishing, gaining acceptance for, insuring effectiveness of, improving, etc. -- the idea. (deferred judgment)	Column B Who, when and/or where	Column C How and/or why? (How to gain acceptance and enthusiasm of others for idea)
1. Discuss with some of children		
2. Suggest sing along with radio if everyone settles down		
3. Appoint student monitors		
4. Have them elect monitors		
5. Stop bus when trouble starts Refuse to start until it stops	On a hot day, On way home or before ball game	With warning Without warning, stop, get magazine, read
6. Set up committee of children to decide on action	Hold and think through if problem persists	
7. Have children propose ideas for group activities during ride		Ask children to bring tape deck or transitor radio
8.		(offer prize for best activity idea)
9.		
10.		

Now go back and circle suggestions in Column A (Judgment); then list thoughts regarding who, when, where, how, and why for each circled item as indicated in Columns B & C. Search for several alternatives in Columns B & C for each circled item in Column A. Then decide on the best alternative in each case.

Illustration of Creative Problem-Solving Thought Process on a Very Minor Problem (Entire process can flash through mind in a few moments)

1. The "Mess" - Baby fell through the bottom of his bed as a result of several good jumps on the mattress. Slats did not break, but the nails which secure tne slats to the frame pulled out, permitting mattress and baby to fall to the floor.

2. Some of the facts considered: A) I have assorted tools and lumber. B) I am only interested in making the crib last a few months longer. (Baby will be in another bed by then.) C) Frame of mattress support has already fallen apart several times; the nails have pulled out each time. D) The frame is split in several places as a result of repeated nailing. E) Baby is very active and enjoys bouncing, etc.

3. Other data needed -- no further fact-finding felt necessary.

4. First statement of problem -- How to nail up the frame support again (restricted thinking to the nailing process).

5. Restatement and broadening of problem -- How to prevent baby from falling through the bottom of the crib again.

6. Some sub-problems considered: A) How to stop baby from jumping. B) How to support the mattress effectively. C) How to strengthen the frame. D) How to lessen the distance of the fall in case of breakage.

7. Sub-Problem Chosen -- "What ways can the frame be strengthened" was chosen as the approach for creative attack. (No further information was felt necessary before ideation.)

8. Ideation step -- Some of the ideas conceived on "ways to stregthen frame" were A) nails, B) clamps, C) glue, D) screws, E) rope or string.

9. Evaluative criteria developed -- A) must have effective holding power, B) must allow for speedy completion of job, C) must utilize materials which are available.

10. Evaluation and action: Idea of screws selected and utilized.

It should be recognized in this simple illustration that the only creative aspect of the solution of using screws was the fact that the idea hadn't ever before occurred to this particular person in relation to this particular problem. Without realizing it, he had blocked himself by concentrating on "getting the nails to stick." Each time before, when the bed had been broken, he had always defined the problem as "how to get the frame nailed together effectively." Once he had redefined the problem, the other approaches and possible answers (already existent but obscured by his mental block) emerged for him. Thus, he was able to solve his problem in a new (to him) and better way, hence, creatively.

The preceding is an example of one of those situations where someone else might tell you at the start to use screws; and you would think to yourself, "Why, naturally, how stupid of me! Why didn't I think of that myself!" The answer, of course, is that you didn't see the same problem from your viewpoint as did the disinterested observer. Thus, he mentally defined it differently and consequently arrived at a different and better solution.

By approaching your problems in the creative manner illustrated by the foregoing examples, you force yourself deliberately to see your problem from new viewpoints, which allow you more opportunity for fresh approaches in attacking the problem. Frequently, the moment the problem is redefined, the solution appears almost automatically.

NOTE: By solving the specific sub-problems chosen in the "baby-bed" case, the major problem has been solved. In this example, solving any of the sub-problems would solve the overall problem. In other kinds of situations, ideas regarding <u>each</u> of the sub-problems help to strengthen the solution of the overall problem. Each is a partial solution adding its weight to the effectiveness of the total solution. On the other hand, in the "baby-bed" problem only one approach seems to be necessary. The one idea appears adequate to solve the problem effectively.

<u>Exercise</u> -- Find an example from your own experience where re-definition helped produce the better solution, or look for some rather inconsequential problem that has annoyed you and see if you can re-define it in such a way as to suggest a new solution.

DEVELOPING THE SOLUTION

STUDENT WORKBOOK

Operational Objectives

At the conclusion of this module, it is expected that you will have:

1) utilized the "problem definition" and "deferred judgment" skills learned in previous modules,
2) demonstrated your ability to use "Creative Problem Solving" procedures to solve real problems,
3) internalized "Creative Problem Solving" procedures into your approach to the teaching situation.

Solution Development Worksheet -- Part 1

I. Fact-Finding

Concentrate on column 1 first; then go on to columns 2 and 3.

Column 1	Column 2	Column 3
What other facts would you like to have about the problem? (list fact-finding questions, not judicial or creative ones. Don't worry about whether or not you can get the information; if you would <u>like</u> to have it, raise the question.)	Where might the answers to the most important questions be obtained? List all conceivable sources of information.	Using the best sources, find the answers to the most significant questions and fill them in below.
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
(Use as many pages as you need to list all the questions you would like to have answered.) (When you have exhausted your supply of questions, go back and circle the most important questions.)	(Go back and circle the best sources.)	

Solution Development Worksheet -- Part 2

II. Problem-Finding

List all the creative type questions (problems or challenges) suggested by the problem. ("How might I. . .? In what ways might I. . .? What ideas might I produce to. . .?" etc.) If "fact-finding" or "judicial" type questions occur to you, convert them to "creative" types by restating them as "How might I find out. . .?" or "How might I decide. . .?"

Note the number of problems of this type that are suggested by the "situation" and the additional facts you have been able to gather about this situation.

1. _____

2. _____

3. _____

4. _____

Stop a moment and ask, "What is the real problem?" "What is my basic objective?" "What do I want to accomplish here?" Ask "WHY?" of each problem you have listed. ("Why do I want to do this?") In asking these questions of yourself, try to restate and broaden your problem. For example, asking "Why?" of the problem, "How might I catch the mouse?" could lead to the restatement, "How might I get rid of the mouse?" Try to find problem statements (questions) that give the largest number of possible approaches. Try paraphrasing and finding synonyms in your problem statement.

5. _____

6. _____

7. _____

Now that you have broadened the problem, what other reactive aspects or approaches (sub-problems) can you see that you didn't list earlier?

8. _____

9. _____

10. _____

Now circle the best, most promising problem statement from all that you have listed. Perhaps it is the one that will give you the greatest leeway, the largest number of approaches or areas for exploration, -- the one that includes most of the other ones (sub-problems). Or it may be one of the narrower statements that is really the crux of the situation. In any event, choose the one which is the most significant to you.

NOTE: You may want to go back and carry out additional fact-finding on the first part of this worksheet, now that you have restated your problem. With the new wording, you may be able to list many more facts now.

Solution Finding Worksheet -- Part 3

III. Idea-Finding (deferred judgment)

Problem Statement: (Selected from Part II) _____

_____

(Be sure your problem statement is clear, concise as a telegram; also be sure it starts with words like, "What ways might I. . .?" or "How to. . .?")

IDEAS (tentative leads to solution) (Use any of the sub-problems previously listed as approaches to spur ideas. The following list of idea-spurring questions may also prove effective in helping to generate ideas.)

OTHER USES? SUBSTITUTES? ADAPT? MODIFY? MAGNIFY?
MINIFY? REARRANGE? COMBINE? REVERSE?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____

etc.

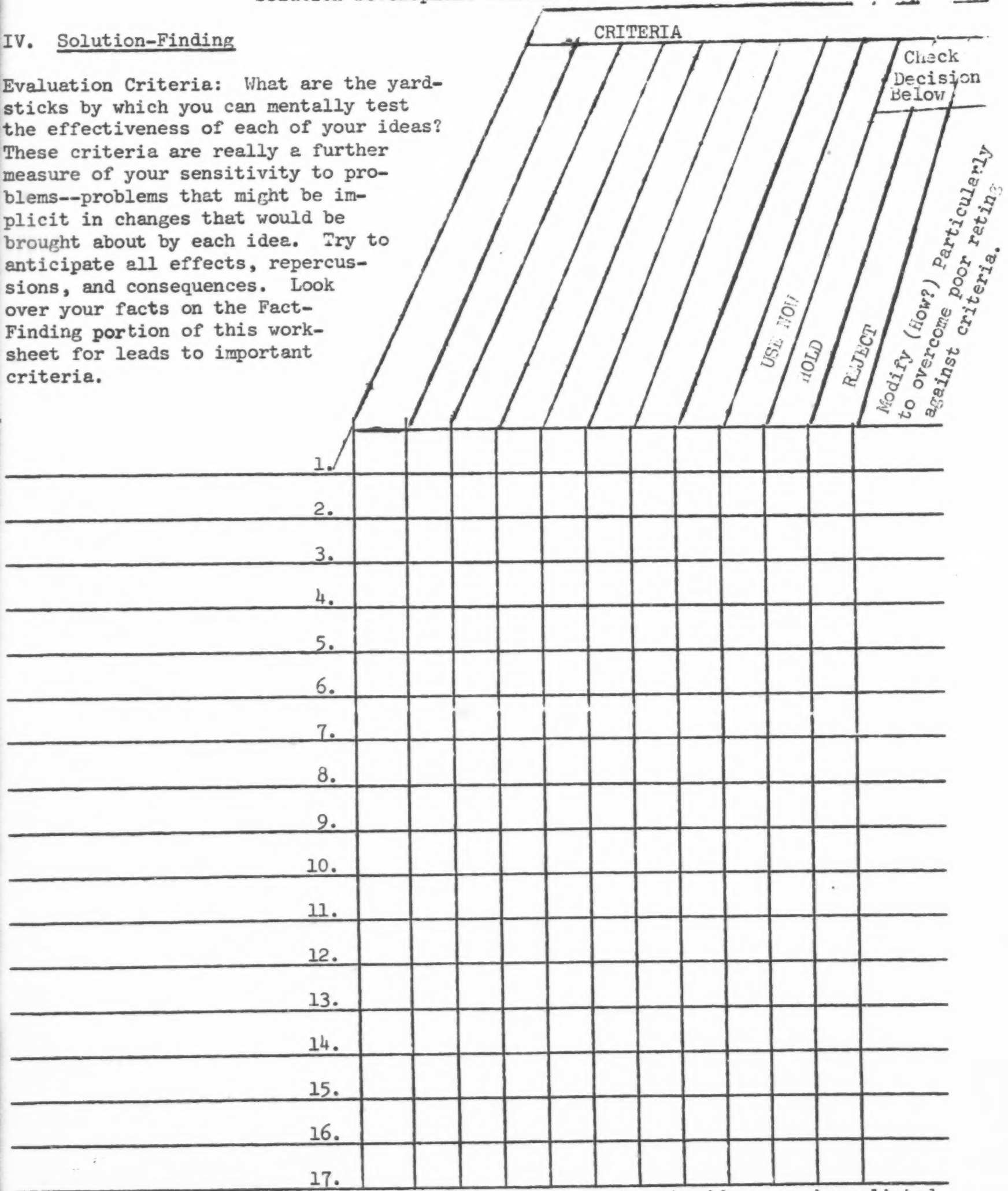
Now go back and circle the ideas that seem to offer the best potential (judgment).

NOTE: If your original problem statement was quite broad, you may find that many of the ideas you list on this sheet may actually be sub-problems. For example, consider the problem, "How might I increase sales in this territory?" You might list such ideas as, "obtain more customers", "step up advertising," etc. In cases like this you would choose one of these "approaches" at a time and then probe for more specific ideas. "How might I obtain more customers?", "How might I step up advertising?", etc. In such cases you will want to repeat this worksheet (using one of the more specific sub-problems as the problem statement each time) and follow all subsequent worksheet procedures for each of these approaches or as many as you deem worthy of development to this extent.

Solution Development Worksheet -- Part 4

IV. Solution-Finding

Evaluation Criteria: What are the yardsticks by which you can mentally test the effectiveness of each of your ideas? These criteria are really a further measure of your sensitivity to problems--problems that might be implicit in changes that would be brought about by each idea. Try to anticipate all effects, repercussions, and consequences. Look over your facts on the Fact-Finding portion of this worksheet for leads to important criteria.



Line up the left margin of this part of the worksheet with the ideas you have listed on Part III. Evaluate the ideas you circled as having the best potential. For each of these ideas, indicate a rating in each block; e.g. 3(good) 2(fair) 1(poor) DP(doesn't pertain) etc. Then make a decision regarding each of the circled ideas (based on its ratings under the various criteria) by checking or commenting in one of the boxes under "Decision."

V. Acceptance-Finding

NOTE: This procedure is designed to help you use creative thinking in preparing to put an idea into effect.

Write idea to be developed here: _____

DO NOT FILL IN THESE COLUMNS UNTIL FINISHED WITH THE FIRST COLUMN (see bottom of page)

Column A Ways of implementing, carrying out, accomplishing, gaining acceptance for, insuring effectiveness of, improving, etc. -- the idea (deferred judgment).	Column B Who, when and/or where?	Column C How and/or why? (How to gain acceptance and enthusiasm of others for idea)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

Now go back and circle suggestions in Column A (Judgment); then list thoughts regarding who, when, where, how , and why for each circled item as indicated in Columns B & C. Search for several alternatives in Columns B & C for each circled item in Column A. Then decide on the best alternative in each case.

What should the bus driver do?

On a public bus the driver can eject rowdies. On a school bus he cannot do this and must deliver the children safely no matter how badly they behave. On one school bus, an eight-year-old boy struck and bit other children and kept the entire bus load in a noisy, confused state. Due to the disturbances, the driver nearly had several accidents. He pointed this out, but the boy jeered and continued behaving in the same way. When the boy's victim complained, the school principal tried to punish the rowdy by keeping him in the office during recess. This had no effect, nor did appeals to his parents. The driver reported that he was as bad as ever but was cautioned by the principal that anyone who spanked him might be sued or prosecuted.

Solution Development Worksheet -- Part 1

I. Fact-Finding

Concentrate on column 1 first; then go on to columns 2 and 3.

Column 1	Column 2	Column 3
What other facts would you like to have about the problem? (list fact-finding questions, not judicial or creative ones. Don't worry about whether or not you can get the information; if you would <u>like</u> to have it, raise the question.)	Where might the answers to the most important questions be obtained? List all conceivable sources of information.	Using the best sources, find the answers to the most significant questions and fill them in below.
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
	a. b. c. d. e. etc.	
(Use as many pages as you need to list all the questions you would like to have answered.) (When you have exhausted your supply of questions, go back and circle the most important questions.)	(Go back and circle the best sources.)	

II. Problem-Finding

List all the creative type questions (problems or challenges) suggested by the problem. ("How might I. . .? In what ways might I. . .? What ideas might I produce to. . .?" etc.) If "fact-finding" or "judicial" type questions occur to you, convert them to "creative" types by restating them as "How might I find out. . .?" or "How might I decide. . .?"

Note the number of problems of this type that are suggested by the "situation" and the additional facts you have been able to gather about this situation.

1. _____

2. _____

3. _____

4. _____

Stop a moment and ask, "What is the real problem?" "What is my basic objective?" "What do I want to accomplish here?" Ask "WHY?" of each problem you have listed. ("Why do I want to do this?") In asking these questions of yourself, try to restate and broaden your problem. For example, asking "Why?" of the problem, "How might I catch the mouse?" could lead to the restatement, "How might I get rid of the mouse?" Try to find problem statements (questions) that give the largest number of possible approaches. Try paraphrasing and finding synonyms in your problem statement.

5. _____

6. _____

7. _____

Now that you have broadened the problem, what other reactive aspects or approaches (sub-problems) can you see that you didn't list earlier?

8. _____

9. _____

10. _____

Now circle the best, most promising problem statement from all that you have listed. Perhaps it is the one that will give you the greatest leeway, the largest number of approaches or areas for exploration, -- the one that includes most of the other ones (sub-problems). Or it may be one of the narrower statements that is really the crux of the situation. In any event, choose the one which is the most significant to you.

NOTE: You may want to go back and carry out additional fact-finding on the first part of this worksheet, now that you have restated your problem. With the new wording, you may be able to list many more facts now.

Solution Finding Worksheet -- Part 3

III. Idea-Finding (deferred judgment)

Problem Statement: (Selected from Part II) _____

_____

(Be sure your problem statement is clear, concise as a telegram; also be sure it starts with words like, "What ways might I. . .?" or "How to. . .?")

IDEAS (tentative leads to solution) (Use any of the sub-problems previously listed as approaches to spur ideas. The following list of idea-spurring questions may also prove effective in helping to generate ideas.)

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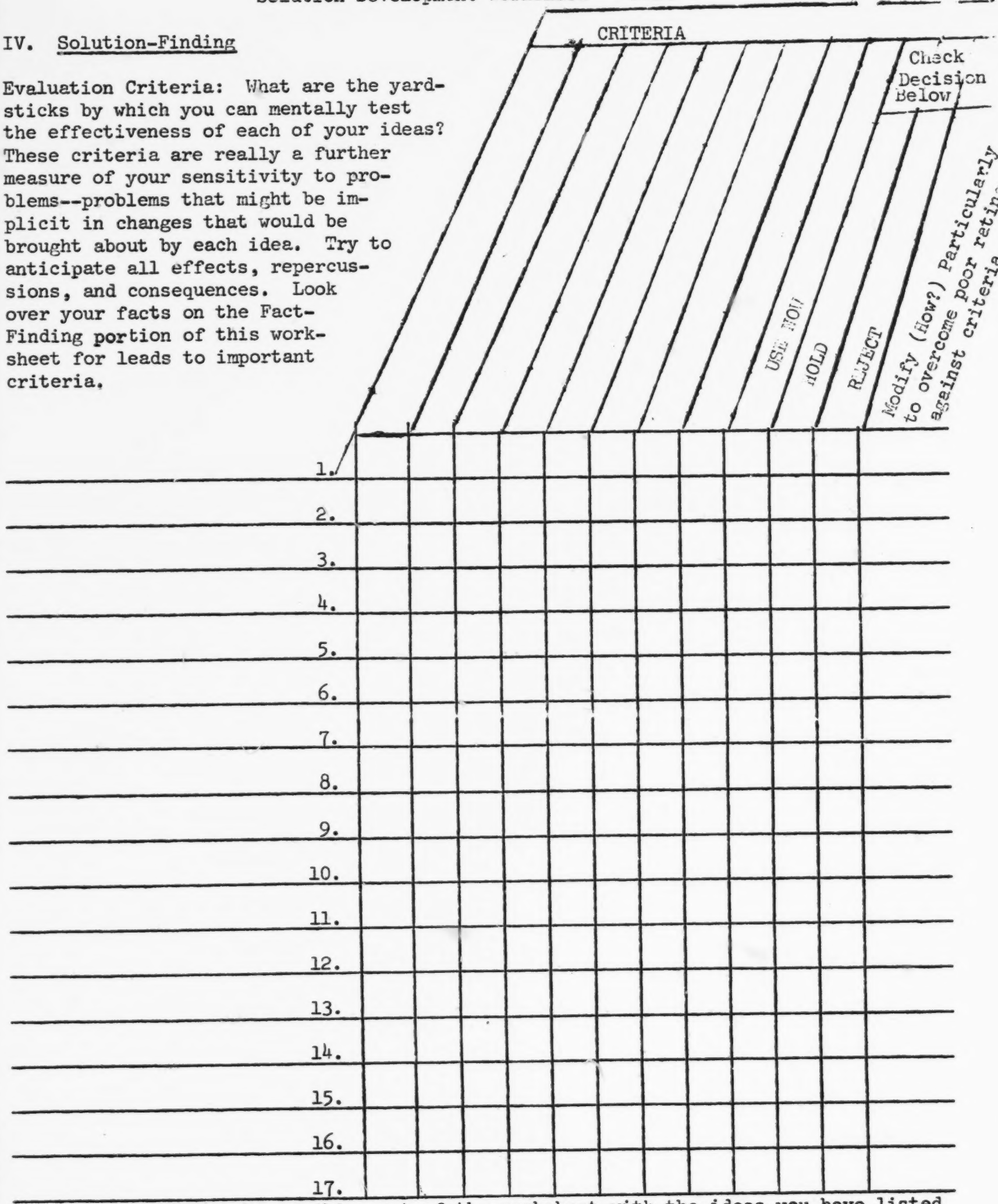
etc.

Now go back and circle the ideas that seem to offer the best potential (judgment).

NOTE: If your original problem statement was quite broad, you may find that many of the ideas you list on this sheet may actually be sub-problems. For example, consider the problem, "How might I increase sales in this territory?" You might list such ideas as, "obtain more customers", "step up advertising," etc. In cases like this you would choose one of these "approaches" at a time and then probe for more specific ideas. "How might I obtain more customers?", "How might I step up advertising?", etc. In such cases you will want to repeat this worksheet (using one of the more specific sub-problems as the problem statement each time) and follow all subsequent worksheet procedures for each of these approaches or as many as you deem worthy of development to this extent.

IV. Solution-Finding

Evaluation Criteria: What are the yardsticks by which you can mentally test the effectiveness of each of your ideas? These criteria are really a further measure of your sensitivity to problems--problems that might be implicit in changes that would be brought about by each idea. Try to anticipate all effects, repercussions, and consequences. Look over your facts on the Fact-Finding portion of this worksheet for leads to important criteria.



Line up the left margin of this part of the worksheet with the ideas you have listed on Part III. Evaluate the ideas you circled as having the best potential. For each of these ideas, indicate a rating in each block; e.g. 3(good) 2(fair) 1(poor) DP(doesn't pertain) etc. Then make a decision regarding each of the circled ideas (based on its ratings under the various criteria) by checking or commenting in one of the boxes under "Decision."

Solution Development Worksheet -- Part 5

V. Acceptance-Finding

NOTE: This procedure is designed to help you use creative thinking in preparing to put an idea into effect.

Write idea to be developed here: _____

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Column A Ways of implementing, carrying out, accomplishing, gaining acceptance for, insuring effectiveness of, improving, etc. -- the idea (deferred judgment).	Column B Who, when and/or where?	Column C How and/or why? (How to gain acceptance and enthusiasm of others for idea)
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Now go back and circle suggestions in Column A (Judgment); then list thoughts regarding who, when, where, how , and why for each circled item as indicated in Columns B & C. Search for several alternatives in Columns B & C for each circled item in Column A. Then decide on the best alternative in each case.

Illustration of Creative Problem-Solving Thought Process on a Very Minor Problem (Entire process can flash through mind in a few moments)

1. The "Mess" - Baby fell through the bottom of his bed as a result of several good jumps on the mattress. Slats did not break, but the nails which secure the slats to the frame pulled out, permitting mattress and baby to fall to the floor.

2. Some of the facts considered: A) I have assorted tools and lumber. B) I am only interested in making the crib last a few months longer. (Baby will be in another bed by then.) C) Frame of mattress support has already fallen apart several times; the nails have pulled out each time. D) The frame is split in several places as a result of repeated nailing. E) Baby is very active and enjoys bouncing, etc.

3. Other data needed -- no further fact-finding felt necessary.

4. First statement of problem -- How to nail up the frame support again (restricted thinking to the nailing process).

5. Restatement and broadening of problem -- How to prevent baby from falling through the bottom of the crib again.

6. Some sub-problems considered: A) How to stop baby from jumping. B) How to support the mattress effectively. C) How to strengthen the frame. D) How to lessen the distance of the fall in case of breakage.

7. Sub-Problem Chosen -- "What ways can the frame be strengthened" was chosen as the approach for creative attack. (No further information was felt necessary before ideation.)

8. Ideation step -- Some of the ideas conceived on "ways to stregthen frame" were A) nails, B) clamps, C) glue, D) screws, E) rope or string.

9. Evaluative criteria developed -- A) must have effective holding power, B) must allow for speedy completion of job, C) must utilize materials which are available.

10. Evaluation and action: Idea of screws selected and utilized.

"It should be recognized in this simple illustration that the only creative aspect of the solution of using screws was the fact that the idea hadn't ever before occurred to this particular person in relation to this particular problem. Without realizing it, he had blocked himself by concentrating on "getting the nails to stick." Each time before, when the bed had been broken, he had always defined the problem as "how to get the frame nailed together effectively." Once he had redefined the problem, the other approaches and possible answers (already existent but obscured by his mental block) emerged for him. Thus, he was able to solve his problem in a new (to him) and better way, hence, creatively.

The preceding is an example of one of those situations where someone else might tell you at the start to use screws; and you would think to yourself, "Why, naturally, how stupid of me! Why didn't I think of that myself!" The answer, of course, is that you didn't see the same problem from your viewpoint as did the disinterested observer. Thus, he mentally defined it differently and consequently arrived at a different and better solution.

By approaching your problems in the creative manner illustrated by the foregoing examples, you force yourself deliberately to see your problem from new viewpoints, which allow you more opportunity for fresh approaches in attacking the problem. Frequently, the moment the problem is redefined, the solution appears almost automatically.

NOTE: By solving the specific sub-problems chosen in the "baby-bed" case, the major problem has been solved. In this example, solving any of the sub-problems would solve the overall problem. In other kinds of situations, ideas regarding <u>each</u> of the sub-problems help to strengthen the solution of the overall problem. Each is a partial solution adding its weight to the effectiveness of the total solution. On the other hand, in the "baby-bed" problem only one approach seems to be necessary. The one idea appears adequate to solve the problem effectively.

<u>Exercise</u> -- Find an example from your own experience where re-definition helped produce the better solution, or look for some rather inconsequential problem that has annoyed you and see if you can re-define it in such a way as to suggest a new solution.